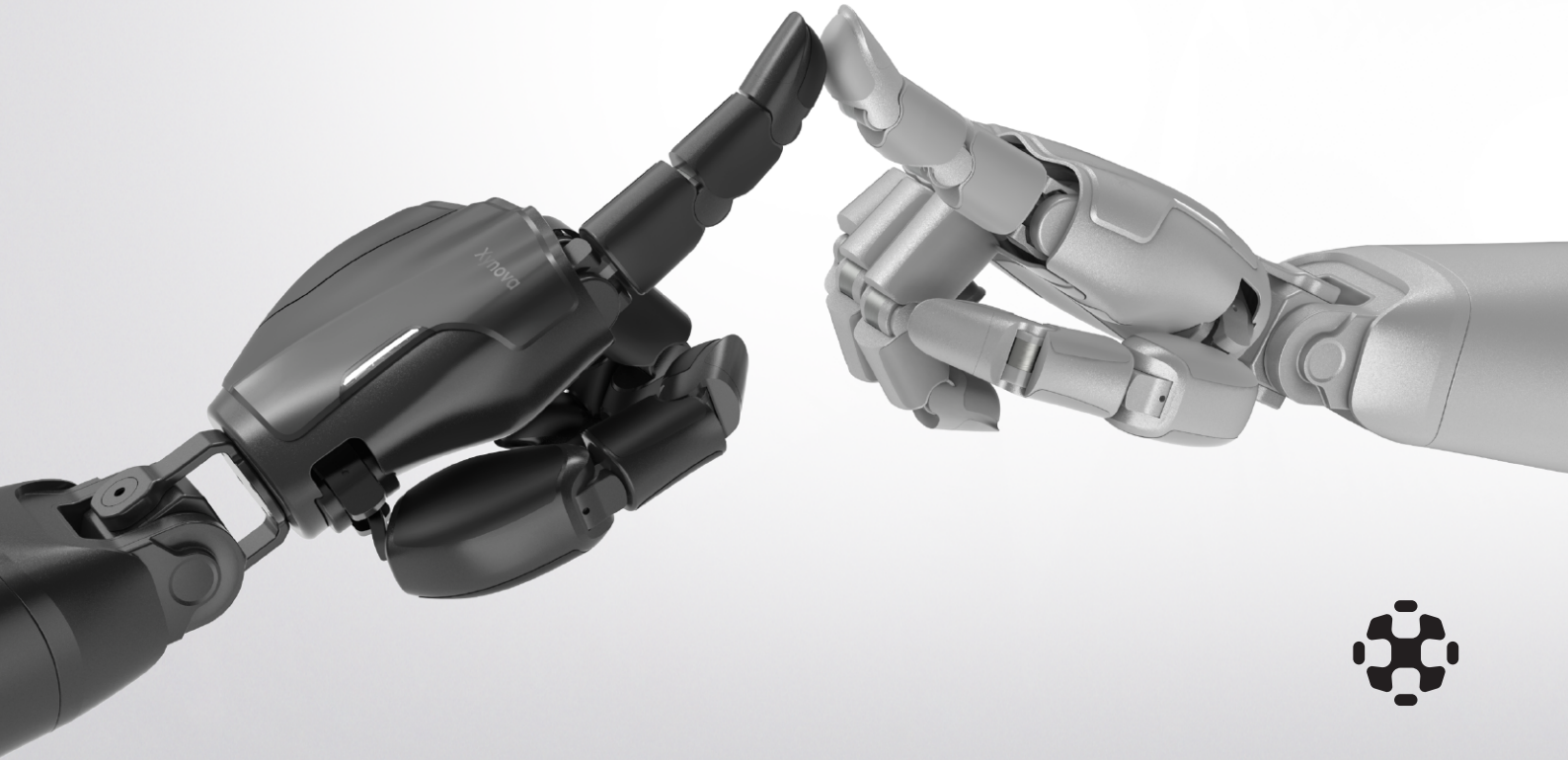
Xynova Prima 1

Direct-Drive Transparency, Perceptive Infinity.



V 1.3

Xynova

Xynova

Xynova Prima 1 adopts a **full-joint direct-drive** architecture, designed as a dexterous hand for high-precision force-controlled operations and cutting-edge embodied AI research. It integrates ultra-compact direct-drive motor modules, micro-gear reduction mechanisms, and a combined visuo-tactile and distributed tactile array, enabling precise closed-loop control from perception to execution. Featuring an advanced thermal management design, it is the ideal choice for unlocking complex delicate tasks and reinforcement learning training.

Strong

Ultra-high payload-to-weight ratio, with **15N** fingertip force.

Measurable

Ultimate force transparency, lossless transmission with **millisecond**-level response.

Agile

Fully direct-drive with zero backlash, instantaneous opening and closing at **0.08s/cycle**.

Receptive

Keen **visuo-tactile perception across five fingers**, sensing without boundaries

Tractable

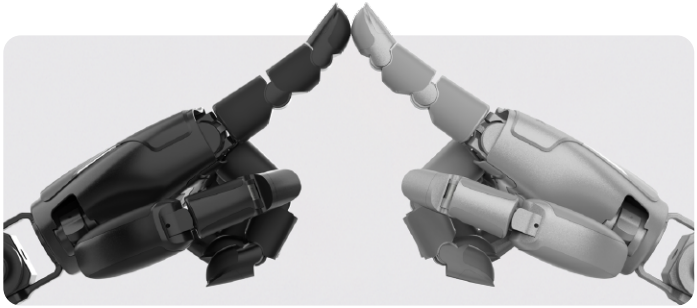
22 DoF biomimetic configuration, ultra-low backdrive for safe interaction.

Ultimate Force Transparency – Redefining Control Intuition

Independent joint closed-loop control: **<10ms** response, **<±0.2°** joint repeatability, fully decoupled – force follows intent, without compensation.

Visuo-Tactile Perception Fusion – Surpassing Human Sensing

Fingertip Visuo-tactile: Ultimate 3D perception at the end-effector, **0.1N** sensitivity, minimal trigger from contact to cognition.



AI-Friendly, Out-of-the-Box Training Platform

Standard protocols to mainstream ecosystem, high-frequency feedback, plug-and-play, zero tuning, **MIT control supported** – ideal for RL and embodied AI training.

Bionic Form with Industrial-Grade Power

1:1 fully bionic appearance with a payload-to-weight ratio **exceeding 20:1** and a non-thumb fingertip force ≥15N – resembling a human hand, yet stronger.

Xynova Prima 1 Product Standard Parameters

Electrical Parameters	Rated Voltage	24V
	Rated Current	5A
Structural Characteristics	Degrees of Freedom	22
	Transmission Mode	Direct-drive
	Hand Weight	850g
	Hand Size	190 × 90.5 × 44mm
	Grip Diameter Range	Φ10~220mm
Software Support	Secondary Development	SDK provided, compatible with ROS 1 & ROS 2, URDF models included
	Simulation Environment	MuJoCo and Isaac Lab supported
	Operational Support	Built-in kinematics library and reinforcement learning examples
	OTA Update	Supported

[1] With vertical wrist and bent fingers
[2] With horizontal wirst and straight fingers

Performance Parameters	Grip Time	0.08s/times
	Max. Fingertip Force	15N
	Vertical Payload [1]	20kg
	Horizontal Payload [2]	10kg
	Force Control Accuracy	0.5N
	Repeatability	0.5mm
	Min. Backdrive Force	0.2N
	Tactile Sensor Type	Visuo-tactile (fingertip-3D)
	Min. Trigger Force	0.1N
	Tactile Sensor Resolution	0.1N
Range of Motion	Thumb Pitch/ Rotation Angle	-10°~90°/ 0°~100°
	Non-thumb Pitch/ Yaw Angle	-30°~105°/ -20°~20°
Control and Communication	Communication Mode	CAN FD/ EtherCAT
	Control Mode	Multimodal perception intelligent control

High-Density Data Output with Visuo-Tactile Multidimensional Perception

Fingertips capture **3D force** distribution, morphology, texture, and more. Superhuman tactile feedback provides high-density sensory input for intelligent decision-making.

Micron-Level Spatial Resolution with High-Density Sensing Array

640 × 360 sampling points with micron-level element spacing. Ultra-high-density array precisely captures contact force distribution and detects microscopic variations.

0.1N Force Resolution with Highly Sensitive 3D Force Detection

Normal and tangential trigger force as low as **0.1N**, accuracy **<5% FS**. Real-time 3D force direction sensing reconstructs contact force vectors for precise control.

Long-Term Industrial Reliability with 2-Million-Cycle Visuo-Tactile Lifespan

Temperature drift and zero drift as low as **1% FS**. Stable operation from **-10°C~50°C**. visuo-tactile sensing module **>2 million** effective press cycles for demanding industrial environments.

Xynova Prima 1 Sensing Module Parameters

Sensing Mode	Visuo-tactile (for fingertips)
Taxel Pitch	Micrometer-level
Trigger Force	0.1N
Resolution	0.1N
Range	0.1N~20N
Accuracy	<5% FS
Sampling Resolution	640 × 360
Temperature Drift	1% FS
Zero Drift	1% FS
Repeatability	3% FS
Noise	0.5% FS

Size/ Effective Sensing Area	> 90% of the fingertip area
Module Thickness	13mm
Response Time	40ms
Linearity	5% FS
Sampling Rate	60Hz
Operating Temperature	-10°C~50°C
Effective Press Cycles	2 Million
Max. Overload Force	40N
Operating Voltage	5V
Operating Current	80mA
Communication Mode	USB 2.0

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